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## Circular No. 97 - Growing Alfalfa-Seed

John W. Carlson

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# Growing Alfalfa-Seed

JOHN W. CARLSON



Seed of improved alfalfa varieties is best grown in hills or cultivated rows.

Utah Agricultural Experiment Station  
Utah State Agricultural College  
LOGAN, UTAH

# Growing Alfalfa-Seed<sup>1</sup>

John W. Carlson<sup>2</sup>

## SEED SHOULD BE GROWN FROM SUPERIOR VARIETIES AND STRAINS OF ALFALFA

The present tendency in alfalfa improvement is to establish narrow types or strains for special purposes and which are adapted to a particular set of conditions. It was at one time thought that an alfalfa variety with numerous types of plants would have a wider range of adaptability to diverse conditions and that intercrossing among the different plants would maintain the vigor of the variety.

Hardigan is a new winter-hardy alfalfa which has been developed at the Michigan Agricultural Experiment Station; it has excelled in forage production in Michigan as well as in some of the nearby states. Hardistan, a selection from a Turkestan alfalfa, was developed largely through the efforts of the Nebraska Agricultural Experiment Station. This strain of alfalfa, as well as several others found by investigators of the United States Department of Agriculture, shows a relatively high degree of resistance to the wilt-disease, which is spreading to menacing proportions in many of the alfalfa-growing states. It is highly probable that in the near future there will be a demand in commercial quantities for seed from wilt-resistant strains.

The quality of winter-hardiness and the ability of alfalfa to resist injury during the cold winters of northern regions are also of great importance. Grimm, Hardigan, Cossack, Ladak, and Ontario Variegated are the commonly accepted winter-hardy varieties for which there is demand in certain of the large alfalfa-growing regions. Common alfalfa has not proved to be fully winter-hardy in the northern regions, but it continues to be grown extensively in all regions where winter-killing is not a factor.

The adoption by growers of improved varieties and strains of alfalfa in the regions for which they are best adapted has been relatively slow. The reason is attributed chiefly to the scarcity and high price of seed of special strains and to the difficulty of growing the seed at home. It happens that the regions of greatest forage production in the United States are not so well adapted to the growing of alfalfa-seed.

## ALFALFA-SEED GROWING IS AN OPPORTUNITY FOR THE UTAH FARMER

Alfalfa-seed growing is largely an opportunity for the western farmer. The grower in Utah can use for this purpose large areas of comparatively cheap land.

**Acknowledgments:** In addition to the acknowledgments made in the previous publication of alfalfa-seed production (Station Bulletin 226), the author wishes to express his indebtedness to George Whornham, Assistant Field Agronomist, in charge of alfalfa-seed studies in Millard County, and to Wallace Sorenson for assistance in taking data on the alfalfa flowers.

<sup>1</sup>A more complete account of the experiments in alfalfa-seed production is contained in Station Bulletin 226, copies of which may be had by writing to the Utah Agricultural Experiment Station, Logan, Utah.

<sup>2</sup>Assistant Agronomist and Superintendent of the Uintah Basin Alfalfa-seed Experimental Farm, Fort Duchesne, Utah.

Progress Report of Project 75—Uintah Basin Alfalfa-seed Experimental Farm.

Publication authorized by Director, February 23, 1932.



Climatic conditions are also generally favorable to the growing of this crop in Utah, and production, as a rule, has been relatively uniform from year to year.

In order to get the largest financial returns from growing alfalfa-seed, it is not necessary to devote the entire alfalfa acreage to seed-growing. It is believed that too much specialization and concentration of the industry in one region may finally result in an abnormal increase in numbers of pests injurious to alfalfa. A smaller acreage in each locality, with a wider dispersion of the seed-growing areas into all parts of the state where alfalfa-seed can be grown, would probably be a safer ultimate basis for the industry. It would then also be possible to utilize intensively the local soil areas, which are particularly suitable to alfalfa-seed growing. Weather conditions vary in different localities from one year to another, and it is not likely that a complete crop failure will result in all of them in the same year.

### OLD AND NEW WAYS OF GROWING ALFALFA-SEED

The common practice of growing alfalfa-seed in the more extensive seed-growing regions of Utah is based upon a plan of using the alfalfa for hay or seed growing, or for both, in the same season, depending upon the crop prospects. The plan involves considerable "guess-work" and has not often resulted in large profits for the average seed grower. Under these conditions high yields have been obtained only in years of unusually favorable weather conditions and on suitable soil types. The irrigated sections of these regions are also those of extensive alfalfa acreages. For various reasons the growers have adopted methods in alfalfa-seed growing which require a minimum of labor and expense. A few of these reasons are:

1. Hay has a low sale value and sufficient for local needs is frequently obtained from one cutting.
2. To leave the second growth for seed is one way to secure a cash income, provided the crop is successful.
3. It is sometimes desirable to attempt a seed crop on alfalfa acreages, which during spring and fall months are used for sheep pasture.
4. A better distribution of labor and a more economical use of equipment facilities and irrigation water is sometimes obtained on large alfalfa acreages when part of it is used for seed-growing.
5. Alfalfa-seed growing is not of basic importance on many of the large alfalfa ranches. Livestock, however, is of primary importance on most of them.

Therefore, these rather common practices in the more extensive seed-growing regions of Utah are apparently justified, and it is highly probable that a large portion of the lower-priced seed of common alfalfa will continue to be produced in this manner. Many growers accustomed to the old methods probably will not be interested in ways of increasing seed yields by means that require more hand labor. Good "seed weather" is of utmost importance to this class of alfalfa-seed growers. It is evident, however, that seed of high purity and of dependable origin cannot be produced successfully under these conditions.

New methods and practices in seed-growing will of necessity have to be adopted when it is desirable to grow seed from and to protect the identity and purity of improved alfalfas. The task will become that of the man who desires to specialize in seed-growing and who is willing to abide by strict rules and regulations aimed at protecting the purity of the improved strains entrusted to him.

When plants from a relatively pure variety are grown in drilled stands for



seed production, the seed stocks of the variety may become contaminated with seed of volunteer alfalfa, which, as seed, has been carried into the fields with irrigation water and by winds. Fields of Cossack alfalfa, which at first had a relatively large proportion of plants with yellow or variegated flowers, have appeared to show a change in the relative proportion of yellow or variegated and

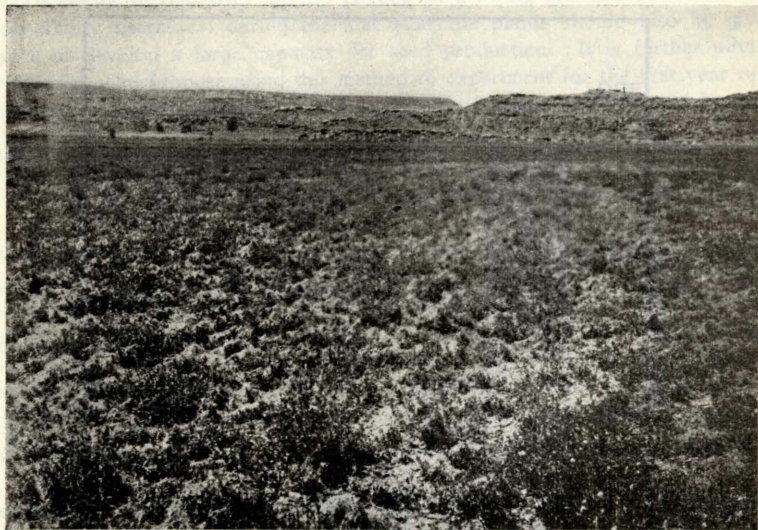


Fig. 1.—The stands in alfalfa fields used continuously for seed-growing are frequently destroyed by weeds. The plants in the field, from which the picture was taken, were being killed by dodder. Crop rotation with a renewal of the alfalfa stand every 5 or 6 years will help to overcome this difficulty. (Courtesy, P. V. Cardon).

purple flowers. The apparent change, it seems, should be attributed largely to the presence in the stand of numerous volunteer alfalfa plants of the common variety. Volunteer reseeding of the Cossack variety may also have produced differentiation or segregation of characters which are dependent upon the genetic nature of the plants in the variety and upon the amount of cross-pollination with common alfalfa in the fields. In actual practice the seed stocks of any relatively pure variety of alfalfa, from which seed is grown in drilled stands, is produced not only from the plants of the original seed sown in the fields but also from several successive generations of those plants, as well as from a varying proportion of plants of a volunteer variety.

When seed-bearing plants of improved varieties are grown in hills, it is possible to preserve the identity of the original plants in a field since volunteer alfalfa plants, dodder, weeds, and sweet clover may soon be detected and practically eliminated by intensive cultivation.<sup>3</sup>

<sup>3</sup>In establishing a strain of alfalfa from a single individual, self-fertilization is necessary (a). This, however, is not the work of the practical seed-grower. After a desired type has been established, the few mother plants are propagated vegetatively by cuttings to secure abundant stock for seed-growing (b). When the plants derived from cuttings become of sufficient size they may also be used as a source of additional cuttings with which to increase the acreage. The genetic composition of vegetatively propagated plants is not changed, as is usually the case in reproduction by seeds. Further, all seeds produced from such plants are of the first generation and will carry the same potential

(a) Westgate, J.M. A Method of Establishing a Strain of Alfalfa from a Single Individual. Proceedings American Breeders' Association, Vol. 2 (1906)

(b) Westgate, J.M., and Oliver, G.W. The Application of Vegetative Propagation to Leguminous Forage Plants. U.S.D.A. Bur. Plant Industry, Bul. 102, Pt. 4. (1907)

## ACRE-YIELDS ARE INCREASED WHEN ALFALFA IS GROWN IN HILLS FOR SEED PRODUCTION

Tests have been conducted at the Uintah Basin Alfalfa-seed Experimental Farm for the purpose of comparing the acre-yields of seed from alfalfa grown in hills with those obtained when grown in rows and drilled in the usual manner. The results are shown in Figure 2 and Table 1.

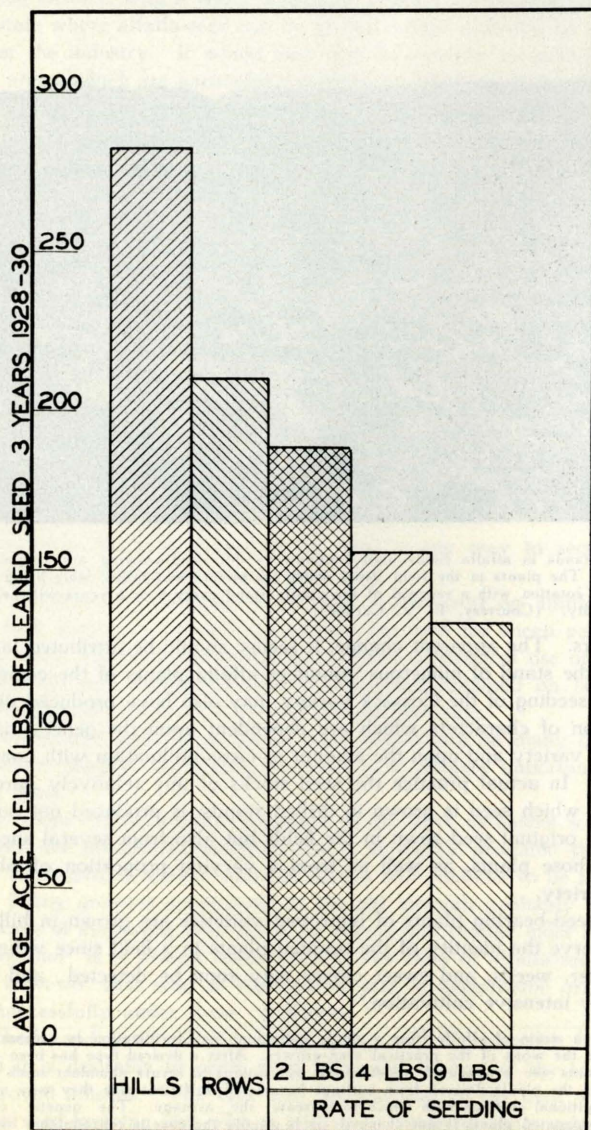


Fig. 2.—Average acre-yield of seed for 1928, 1929, and 1930 of alfalfa grown in hills, rows, and in drilled stands sown at the rate of 2, 4, and 9 pounds to the acre and the relative acre-yields based on the 4-pound seeding as 100 per cent. (See Table 1)



For a 3-year period, average acre-yields of from 200 to 300 pounds of re-cleaned seed were obtained from alfalfa in hills, whereas the crops in surrounding commercial fields were practically complete failures. After the fourth season of growth, the plants made rapid vegetative development and were better adapted to the growing of forage.

To assure success with the hill method of growing alfalfa-seed, weed control is absolutely necessary; during the first year the plants should also be given a chance to develop a large capacity for seed production. It is further advisable for growers who propose using this method to experiment for the first year or two on a relatively small acreage (1 to 5 acres). Hill stands are obtained by sowing

Table 1.—Average acre-yield of seed for 1928, 1929 and 1930 of alfalfa grown in hills, rows, and in drilled stands sown at the rate of 2, 4, and 9 pounds to the acre, and the relative acre-yields based on the 4-pound seeding as 100 per cent.

Type of Stand*	Hills	Rows	Drilled at Various Rates		
			2 Lbs.	4 Lbs.	9 Lbs.
Acre-yield of re-cleaned seed	282	210	189	156	134
Relative yield (%)	180	134	120	100	85

\*The 4-pound seeding gives stands approximately as thick as those in the average commercial fields.

the seed thinly in rows. This may be done with the grain drill, after stopping up part of the holes in the seed box; however, a drill having an extra box for sowing small seeds is best adapted for this purpose. When the regular grain-box of the drill is used for sowing alfalfa seed, the seed should be mixed with large proportion of clean sand. One pound of seed to the acre is sufficient to obtain a satisfactory hill stand. Small acreages may be sown with the garden drill. If necessary to irrigate the seeds, furrows for irrigation may be made with attachments for the same tool. Alfalfa-seed should not be covered with more than 1 inch of soil.

characteristics which may be (1) superior forage qualities, (2) resistance to disease, or (3) winter-hardiness. The work of improving alfalfa, up to this point, is largely that of the plant breeder and the alfalfa-nurseryman. As soon as first-generation seed of the superior strains or varieties becomes available for distribution, the practical seed grower can obtain a few pounds and begin the business of increasing the seed in commercial quantities.

A method of rapidly increasing the seed stocks of improved alfalfa varieties is recommended by Hanson of the South Dakota Agricultural Experiment Station and also a former plant explorer for the United States Department of Agriculture (c). His plan is to grow seedlings from the limited quantities of seed of the original stocks in a nursery or on a small plat of ground which can be given extra care. When the seedlings have made a vigorous growth they are transplanted to the fields and set in hills. He states that this work may be done in the fall, after the harvesting of the grain crop; the plants will then seed abundantly the following year. He describes a horse-drawn transplanting machine which in one day will plant about eight acres to alfalfa.

Seed grown from the transplanted plants will be of the second-seed-generation from the original plants of the strain. If the plants bearing this seed are reproduced by cuttings and acreages are enlarged and renewed as the older plants begin to decline in seed-production, second-generation-seed can be produced indefinitely for commercial use. The specialist in alfalfa-seed growing can profit further by marking, for identification, approximately 100 of the best seedling plants in his field; these heavy seedling plants should also have the qualities of good forage plants. The following spring cuttings can be made from the selected plants and a new acreage started. All plants produced from the cuttings will be heavy seeders and possess forage qualities similar to those of the original selection. Seed produced by plants grown from cuttings will not all produce superior plants but will be true to variety; the majority of them will also have the superior qualities of the plants in the first selection. It is not uncommon to find alfalfa plants that produce 1 ounce of seed each year. Many have been found which have produced more than 2 ounces; others have been re-

(c) Hanson, N.E. Transplanting Alfalfa. S. Dak. Agr. Exp. Sta. Bul. 167 (1916)



Weed-control work should begin as soon as the seeds have germinated; at no time should weeds be allowed to smother or to retard the growth of the alfalfa plants. Thinning must be done with the hoe and fingers, much the same as for sugar-beets. This work should begin as soon as the seedlings have become firmly established in the soil, or when they are about three weeks old.

Experiments show that various spacings of the plants, such as 14 x 28, 21 x 28, 28 x 28, 35 x 28, and 49 x 28 inches, gave no important differences in the acre-yield of seed. In practical seed growing, it is advisable to space the plants at distances that will best facilitate cultivation and harvesting operations. When the rows are 28 inches apart, three of them can be cut with one swath of a 5-foot mower, as is illustrated on the cover page. Rows 3 to 3.5 feet apart can more easily be cultivated with corn cultivators, but only two rows can then be cut with one swath of the mower. The plants in the rows should be thinned to from 12 to 18 inches apart and only one plant left in each hill.

No particular difficulties are encountered in harvesting alfalfa-seed grown on plants in hills. Pea guards, used on mowers for harvesting canning peas, will help to solve the problem of picking up the low-lying branches of the alfalfa plants. Alfalfa plants having sufficient space and equal illumination on all sides produce an abundance of flowers on all the branches, whereas those in thick stands limit the bloom to the tips of the taller branches. A freer circulation of air is also provided among plants thinly spaced; this aids in removing quickly the moisture evaporated from the leaves and stems and helps to prevent the growth of fungous diseases.

### YOUNG PLANTS OF ALFALFA ARE MOST PRODUCTIVE OF SEED

Experimental data show that alfalfa plants are most productive of seed in the second season of their growth, provided conditions for growth have been favorable during the first season. On the average, acre-yields of the third and the fourth seasons were from 25 to 88 per cent less than those of the second season. The decrease was greatest in the case of the thick drilled stands, as is shown in Table 2 and Figure 3. The principal contributing factor in decrease in seed yield appears to be a rapid vegetative development after the second season. In the first two years of growth the plants use a large part of their energy in growing a root system. The retarded development of leaves and stems seems to favor greatly the production of seed. Apparently, the crowding of the plants is also of importance since the decrease is greatest in the thickest stands. If it is true that an active root growth stimulates the seeding tendency, the period during which alfalfa plants

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ported which have produced 3 ounces of seed each year. If an acre of ground were planted to alfalfa in hills spaced 14 x 28 inches, there would be approximately 16,000 plants to the acre. If the plants were of the 1-ounce seeding type, and all of them seeded equally well, the acre-yield would be 1000 pounds. Similarly, in case of the 2-ounce and 3-ounce types the acre-yields would be 2000 and 3000 pounds, respectively.

In the Uintah Basin, reproduction of alfalfa by cuttings, can be accomplished by making from ten to fifty sections from the crowns of the selected plants. Each piece should be from 2 to 5 inches long and contain from four to six buds. The crowns are cut early in the spring, and the pieces are "heeled-in" with buds at one end in moist soil. The buds at the other end are left just above the ground and are not covered with soil. Roots develop from the buds in the soil and stems and leaves from those above the ground. As soon as a root system has begun to form, the cuttings are lifted with a little soil and set out in the fields in hills. At the time of transplanting, it is advisable to cut back the stem and leaf growth. When the soil is moist and the conditions for growth favorable, cuttings will develop into large plants the first season. The following season they can be used for seed production or as a source of additional cuttings until the required area is planted to plants of the desired strain.



**Table 2.**—Acre-yields of seed of alfalfa grown in hills, rows, and in drilled stands sown at the rate of 2, 4, and 9 pounds to the acre, showing a decrease in yields in the third and fourth seasons of the plants' growth as compared with the second.

Type of Stand	Drilled at Various Rates to the Acre														
	Hills			Rows			2 Lbs.			4 Lbs.			9 Lbs.		
Year*	1928	1929	1930	1928	1929	1930	1928	1929	1930	1928	1929	1930	1928	1929	1930
Season of growth	2	3	4	2	3	4	2	3	4	2	3	4	2	3	4
Order of seed crop	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Acre-yield of recleaned seed (lbs.)	358	215	272	304	154	176	270	180	118	271	110	88	286	81	35
Relative** acre-yield (%)	100	60	75	100	50	57	100	66	43	100	40	32	100	28	12
Reduction in*** yield of seed (%)		40	25		50	43		34	57		60	68		72	

\*The acre-yields of seed were less than 100 pounds in all of the plats in 1931. Unusually hot weather and drought prevailed during this season, but it is not known if these conditions were the cause of the low seed yields. It was thought best to omit the data for 1931 from the calculations.

\*\*The relative yields are based on the acre-yields of the first seed crop as 100 per cent.

\*\*\*The reduction in acre-yields is measured as the difference in the relative yields of the second and third seed crops as compared with that of the first.

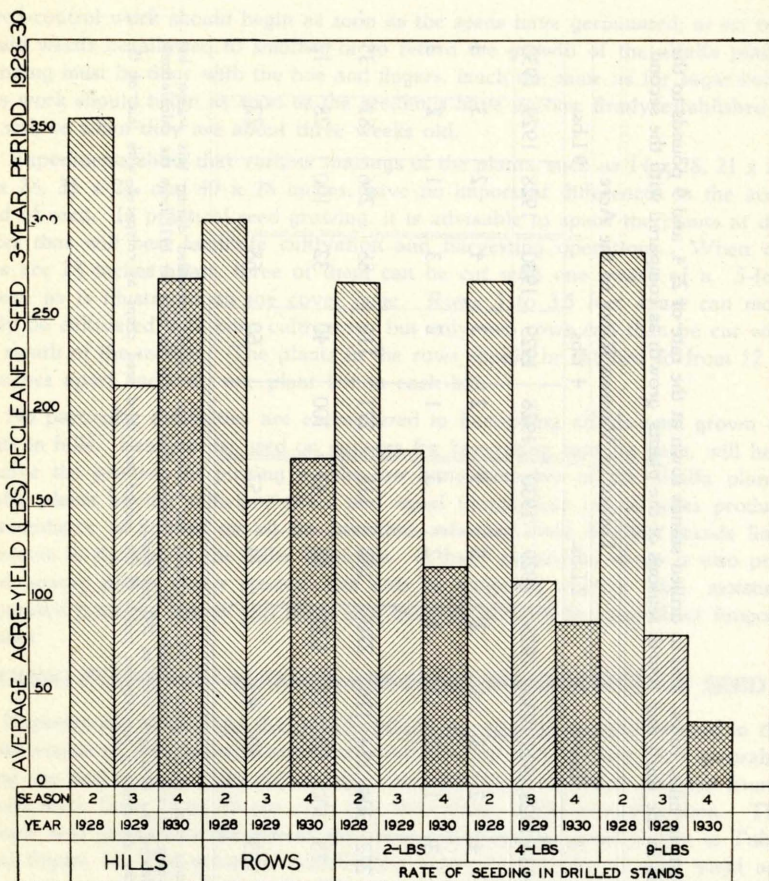


Fig. 3.—Acre-yields of seed of alfalfa grown in hills, rows, and in drilled stands sown at the rate of 2, 4, and 9 pounds to the acre, showing a decrease in yields in the third and fourth seasons of the plants' growth as compared with the second. (See Table 2).

are profitable seed-bearers would probably not be the same for all soil types. The soil at the Experimental Farm is deep and fertile. Drainage is free to a depth of approximately 10 feet, at which level a water-table is encountered. Favorable growing conditions of this type may cause the plants to develop a strong tendency to forage production at a relatively early age, whereas on poorer soils or where the roots can go deeper the seeding period may be somewhat extended.

Data in Table 2 compare the acre-yields of successive seed crops or those which were grown in different years when weather conditions were probably not the same. Another experiment was made in which the first and second seed-crops were grown from the same strains and in the same year. These data are shown in Table 3 and Figure 4. It will be observed that in both tests the highest acre-yields of seed were obtained from the first seed crop, in the second season of growth. These experiments show that alfalfa should be grown in short rotations



for seed production. Since the hills gave a higher acre-yield of seed and also a lower reduction in yield in the succeeding years, it is evident that this would be the best way to grow alfalfa for seed production.

### ALFALFA-SEED GROWING AND THE WEATHER

All the important alfalfa-seed producing regions of the United States are in arid or semi-arid regions. Experimental work done at various places indicates that

Table 3.—Acre-yields of seed of eight strains of alfalfa grown in hills, showing decreased yields for the second seed crop, as compared with the first, regardless of whether both seed crops were grown in different years or in the same year. The relative yields are based on the first seed crop as 100 per cent. A relatively pure strain showed a small difference in the acre-yields of the first seed crops grown in different years, whereas a segregating strain showed a wide difference. Varieties having many plant types show relatively larger variations in acre-yield of the first seed crops, grown in two different years, as compared with a purer strain.

*Alfalfa Strain	Unselected Utah Common			Heavy-seeding Habit Sask. 666-U-15			Segregating for Seeding Habit Hardigan-20			Average of 5 Good Forage Types		
Year	1930	1931	1931	1930	1931	1931	1930	1931	1931	1930	1931	1931
Season of growth	2	2	3	2	2	3	2	2	3	2	2	3
Order of crop	1	1	2	1	1	2	1	1	2	1	1	2
Acre-yield of re-cleaned seed	271	217	190	519	542	341	168	249	98	202	177	134
Relative acre-yields in (%) 1st and 2d seed crops, grown from same plants in different years	100		70	100		65	100		58	100		66
**Relative acre-yields in(%)1st and 2d seed crops grown in the same year (1931)		100	87		100	62		100	39		100	75
***Relative acre-yield of 1st crop seed of same strains in different years	100	80		100	104		100	148		100	82	

\*Seed was obtained from 7 individual alfalfa plants which in a previous test had been found to be superior for seed or forage production. The plants grown from seed of a plant of Saskatchewan 666 closely resembled the parent and were of the heavy-seeding habit. Those from a plant of Hardigan differed or segregated in respect to seeding habit. The remaining plants were all of good forage type and the seed-yields were averaged for this comparison.

\*\*When the seed is harvested from the same plants in different years, the principal variable is a difference in the weather during the two years.

\*\*\*When seed is grown from 1-year-old and 2-year-old plants, respectively, but of the same strain and in the same year, several variables are important: (1) Plants of the same strain may not be alike genetically; (2) they are grown in different locations in the field; and (3) there is a difference in age in the two groups of plants. Weather conditions, however, are the same for both groups.

air moisture is an important element of the weather which influences seed-setting in alfalfa. At the Uintah Basin Alfalfa-seed Experimental Farm, the highest percentage of the flowers formed seedpods when the relative humidity, or the degree

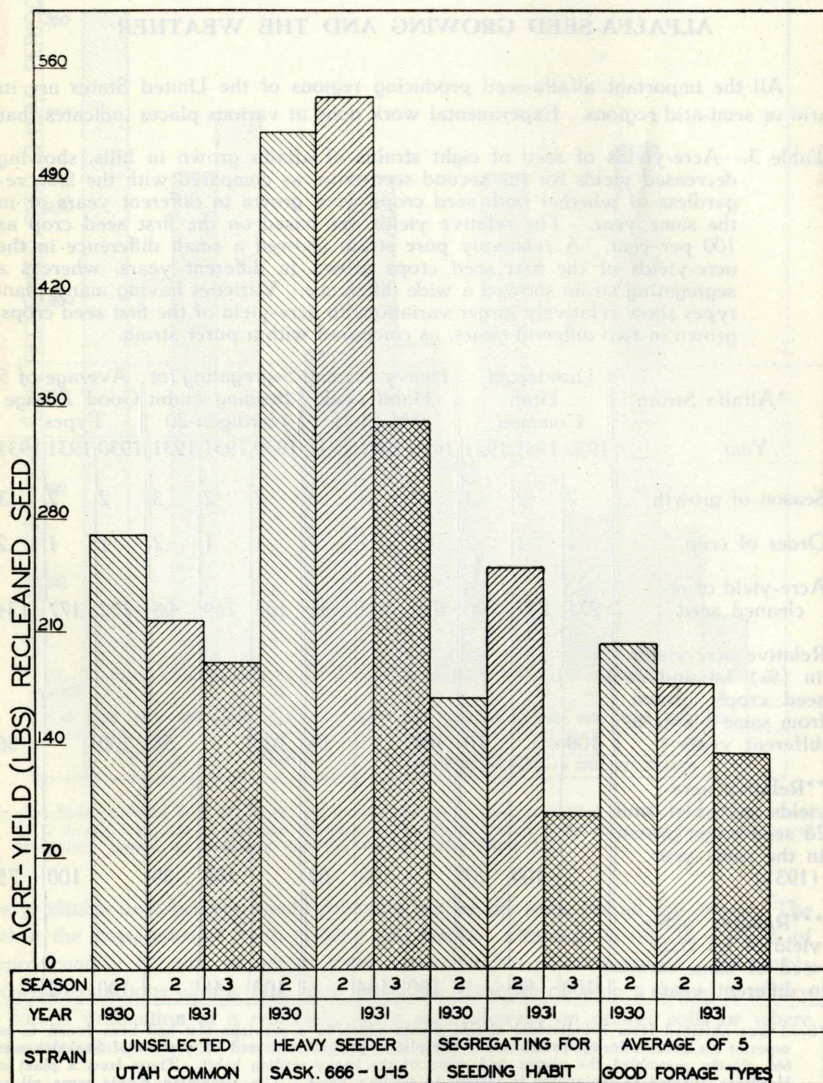


Fig. 4.—Acre-yields of seed of eight strains of alfalfa grown in hills, showing decreased yields for the second seed crop, as compared with the first, regardless of whether both seed crops were grown in different years or in the same year. The relative yields are based on the first seed crop as 100 per cent. A relatively pure strain showed a small difference in the acre-yields of the first seed crops grown in different years, whereas a segregating strain showed a wide difference. Varieties having many plant types show relatively larger variations in acre-yield of the first seed crops, grown in two different years, as compared with a purer strain. (See Table 3)



of saturation in the air, was from 36 to 65 per cent, at temperatures ranging from 72° to 89° F. Stripping of flowers was greatest during and following periods of sultry weather or when the relative humidity was 70 per cent or more, with high temperatures (90°F. or more). Stripping also followed days of hot and drying winds, when the air moisture was less than 20 per cent at high temperatures.

Moderately warm and sunny days, with a gentle breeze to keep the air in circulation, are believed to be favorable to seed-setting in alfalfa. An occasional rain, apparently, does no harm, provided sultry weather does not follow. Conditions of this kind are found most frequently in the Uintah Basin during June and after the middle of August. At the Experimental Farm, on the average the greatest decrease in the percentage of flowers forming pods was obtained during late July and early August. The weather during this period in 1929, 1930, and 1931 was often hot and sultry. Thunder showers were of frequent occurrence in the mountains and foothill country; occasionally, they would extend into the seed-growing areas. The forenoon of the days of this period were usually pleasant and sunny. During the afternoon the sky was frequently cloudy and the air hot and sultry; at other times hot and drying winds would blow. When thunder showers extended into the seed-growing areas, they were often followed by clear skies and high temperatures, which caused a steamy air to envelop the alfalfa foliage.

Usually, the quiet and sunny days of June and late August were followed by cool nights and clear skies. The studies indicate that these conditions are favorable to seed-setting, whereas warm nights and a sultry air seem to be associated with excessive stripping of the flowers. The nights following days of strong winds were sometimes warm; at other times the temperatures would fall to near the freezing point. The air on these nights was usually quite dry. Dew at low temperatures during the night did not appear to retard seed-setting.

Relatively short periods of favorable weather conditions, at a time when the flowers are sensitive and responsive, are sufficient to cause an abundance of seed-pods to form on plants growing on practically every soil type in the seed-growing area. The weather usually does not remain favorable to seed-setting at all times during the season. It is characterized more by sudden changes, particularly during July and August. Low acre-yields of seed often follow a failure of alfalfa flowers to seed well during July and early August, whereas good seed years have been those in which seed-setting was uniformly high throughout the season.

### CLIPPING OR PASTURING-OFF THE FIRST GROWTH OF ALFALFA FOR SEED PRODUCTION

Under the varying conditions of different years and regions, it has not been determined which growth of alfalfa should be left for seed. It appears that the best practice is determined largely by the weather, the length of the growing season, and insect pests. It is doubtful if any one plan of clipping will be found to be "best" for all areas and seasons.

Table 4 and Figure 5 include data showing the percentage of flowers forming pods by periods for five years. On the average, more flowers formed seedpods from June 15 to 30 of each year than at any other time during each of the five seasons. The lowest percentage of flowers formed seedpods from July 15 to August 10, after which seed-setting began again to improve. Of the five years



Table 4.—Showing the percentage of alfalfa flowers that formed seedpods, at the Uintah Basin Alfalfa-seed Experimental Farm, during four periods of the seasons 1927-31, inclusive. On the average, the highest percentage of the flowers formed pods from June 15-30 and the lowest percentage formed pods from July 15 to August 10 of each year.

Period in Season	Percentage of Flowers Forming Seedpods					Avg. by Periods
	1927	1928	1929	1930	1931	
June 15-30	40.9	22.8	No data	30.5	42.1	34.0
July 1-15	No data	13.2	26.2	30.7	20.9	22.7
July 16-Aug. 10	32.5	27.0	8.5	8.0	7.3	16.6
Aug. 11-21	No data	No data	23.4	17.9	23.0	21.4
Average by Years	36.7	21.0	19.3	21.7	23.4	

from 1927 to 1931, inclusive, 1927 and 1928 are considered to be the most successful seed years in the Uintah Basin, while 1929 and 1930 were uniformly poor ones. In 1931, weather conditions were favorable for seed-setting during June and again after August 15.

In the Uintah Basin seed has often been produced most successfully from the first growth or that which has been clipped or pastured-off early. When the first growth is cut late, in order to give one crop of hay, or is pastured off until June 10, the blooming period of the second growth comes on soon after July 10, when conditions are usually not so favorable for seed-setting. Apparently, a more consistent level of seed production can be maintained in the fields of the Uintah Basin, provided the first growth of the alfalfa can be brought into bloom soon after June 10. After this time there is little danger from frost, and conditions are generally favorable to seed-setting. However, in much of the seed area this is possible only when measures are taken to control the alfalfa weevil<sup>4</sup>. A few exceptions to this rule will be found in some sections where conditions are not the same, such as on South Myton bench and in Pleasant Valley which have a longer growing season. In this locality a late blooming period in August and early September has been found to be more favorable. In general, it has not been found profitable to grow alfalfa-seed on land where it is difficult to control the vegetative growth of the plants and to properly time the blooming period.

### IRRIGATING ALFALFA FOR SEED PRODUCTION

The response in vegetative growth of the plants appears to be the best guide in the judicious use of irrigation water in alfalfa-seed growing. The proper amount to use and when to apply it depends largely upon the soil type and the season. Good seed crops have been produced on wet alkaline lands and on soils with a water-table within easy reach of the alfalfa roots. Dry-land areas, having deep soils of medium fertility, have also given good acre-yields of alfalfa-seed. Deep and fertile soils which produce prolific hay-yields are suitable for seed-growing only when the moisture relationships are just right. Shallow soils which are underlaid with hardpan and heavy clay soils which are somewhat impervious to

<sup>4</sup>Sorenson, C. J., "Insects in Relation to Alfalfa-Seed Production". Utah Agr. Exp. Sta. Cir. 98 (1932).



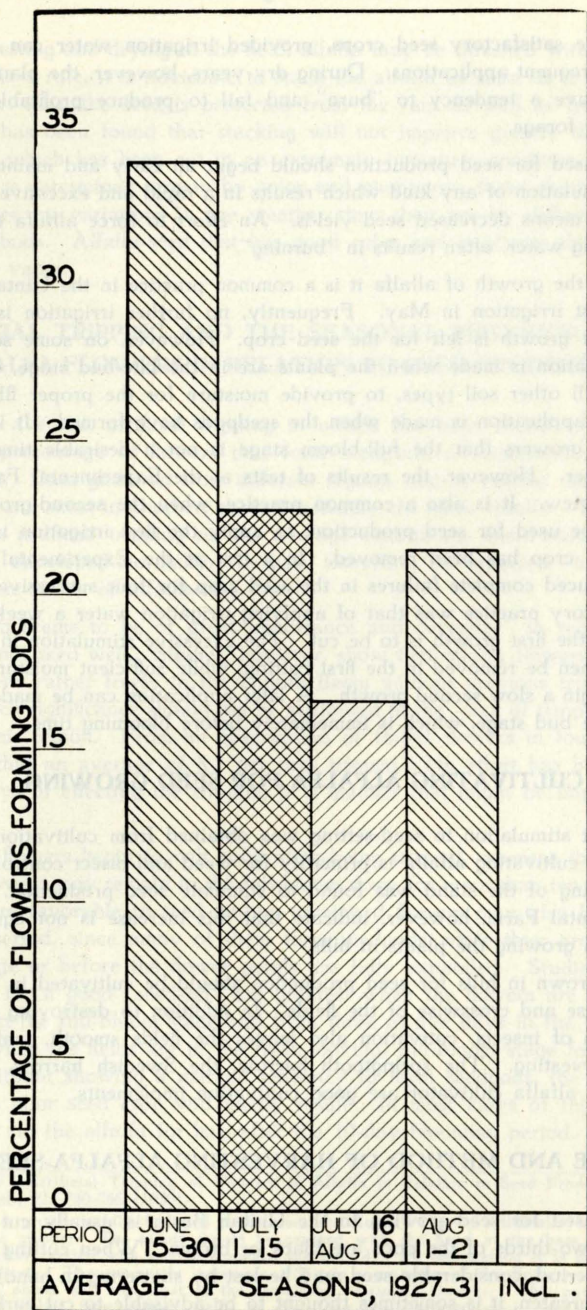


Fig. 5.—Showing the percentage of alfalfa flowers that formed seedpods at the Uintah Basin Alfalfa Seed Experimental Farm, during four periods of the seasons 1927-31, inclusive. On the average the highest percentage of the flowers formed pods from June 15 to 30 and the lowest percentage formed pods from July 15 to August 10 of each year. (See Table 4)

water produce satisfactory seed crops, provided irrigation water can be applied in light and frequent applications. During dry years, however, the plants on these soils types have a tendency to "burn" and fail to produce profitable crops of either seed or forage.

Alfalfa used for seed production should begin an early and maintain a slow growth. Stimulation of any kind which results in a rapid and excessive vegetative growth often means decreased seed yields. An effort to force alfalfa to set seed, by withholding water, often results in "burning".

To start the growth of alfalfa it is a common practice in the Uintah Basin to apply the first irrigation in May. Frequently, no further irrigation is necessary when the first growth is left for the seed crop. However, on some soil types a second application is made when the plants are in the late-bud stage, or early in June. On still other soil types, to provide moisture for the proper filling of the seed, a third application is made when the seedpods have formed. It is generally conceded by growers that the full-bloom stage is not a desirable time to apply irrigation water. However, the results of tests at the Experimental Farm do not support this view. It is also a common practice, when the second-growth of the alfalfa is to be used for seed production, to apply the first irrigation immediately after the hay crop has been removed. In a test at the Experimental Farm this practice produced complete failures in the seed crop for four successive years. A more satisfactory practice was that of applying irrigation water a week or so before the time the first growth is to be cut. The excessive stimulation in vegetative growth can then be removed in the first cutting, while sufficient moisture is left in the soil to begin a slow second growth. A later application can be made when the plant is in the bud stage, which is immediately before blooming time.

### **CULTIVATING ALFALFA FOR SEED GROWING**

No direct stimulation to seed-setting was obtained from cultivation practices. The object of cultivating alfalfa is primarily for weed and insect control. In some cases a thinning of the stand was found to stimulate seed production. Trials at the Experimental Farm, however, indicate that this increase is not equal to that obtained from growing the plants in hills.

Alfalfa grown in hills for seed production should be cultivated in the spring, both lengthwise and crosswise of the fields. In addition to destroying weeds and various forms of insects, cultivation also leaves the fields smooth, which greatly facilitates harvesting. The springtooth harrow, the Swedish harrow, and the tractor-drawn alfalfa cultivator are good cultivation implements.

### **TIME AND METHOD OF HARVESTING ALFALFA-SEED**

Alfalfa used for seed-growing in the Uintah Basin is usually cut when approximately two-thirds of the pods are black or brown. When cutting is delayed beyond this period, considerable seed may be lost by shattering in handling. When early frosts threaten, it is sometimes thought to be advisable to cut earlier than at this stage of maturity. This will often result in a lower acre-yield; however, seed which is recovered after recleaning operations is practically equal in value for planting to that harvested at the normal time.



After cutting and drying in the field, alfalfa may be threshed without previous stacking. As a rule, it is advisable to stack the alfalfa as soon as it becomes sufficiently dry; thus, the seed is protected from the rain as well as from excessive drying. It has been found that stacking will not improve greatly the quality of alfalfa-seed which has been cut in an extremely immature condition. Quality in alfalfa-seed is determined largely by color and plumpness; these characters are influenced more by variations in the weather than they are by differences in production methods. Alfalfa-seed that has good color and is plump also has a high germinating value.

### ARTIFICIAL TRIPPING AND THE SEASONAL BEHAVIOR OF THE ALFALFA FLOWERS IN RELATION TO SEED PRODUCTION<sup>5</sup>

On the average, artificial tripping in alfalfa has been found to more than double the percentage of flowers that form seedpods, as compared with normal development. Data gathered from different regions and in various countries, some in one year and some in another, show practically the same results. The seedpods formed from artificial tripping on the average contain the same number of seeds as do those developed normally. It may, therefore, be expected to result in increased acre-yields of alfalfa-seed.

Tripping seems to be of great importance and necessity in regions where alfalfa does not seed well. Studies, however, show that alfalfa flowers are capable of setting seed rather freely in the Uintah Basin without previous tripping; therefore, too much significance should not be attributed to the lack of tripping in alfalfa flowers in this region. From an observation of 16,541 flowers in four seasons, it was found that an average of 8.1 per cent tripped. No effort has been made to discover ways of effecting the tripping in a manner that might be important commercially<sup>6</sup>.

Alfalfa flowers begin to wilt soon after being tripped, whereas in some years untripped flowers may remain in the full-bloom stage for more than ten days. When conditions are favorable to seed-setting, untripped flowers may also have a short full-bloom period, since many of them form seedpods while they are still in the late-bud stage or before the flower petals are fully expanded. Studies show that the chances for a good "seed-set" are greatest when the flowers are from one to three days in the full-bloom stage and from three to five days in the wilted stage. As a rule, when the fields are in the fresh-looking, full-bloom stage for a week or ten days, without showing a marked tendency to form seedpods, the chances are great that a poor seed crop will finally result. In most cases of this kind, it is advisable to cut the alfalfa for hay after the 10-day blooming period.

<sup>5</sup>Carlson, J. W., Artificial Tripping of Flowers in Alfalfa in Relation to Seed Production. In Jour. Am. Soc. Agron., 22: 780-786 (1930).

<sup>6</sup>When alfalfa is grown in hills for seed production, the flowers can be artificially tripped by hand in the following manner: The plants should be grasped with the hand at the base and successive pressure or strokes exerted with intervals toward the top (d). By this method it is possible to work ten plants a minute. The successive pressures will trip a majority of the flowers, while a second working of the plants will trip most of the remaining untripped flowers. The possible effect of insects carrying pollen from distant fields to the flowers of certified stock can be largely overcome by keeping the flowers artificially tripped. This can be done by working the plants every morning, in the manner described. It does not appear probable that insects can exert any effect on the stigma of the flower after it has once been tripped by other agencies.

(d) Westgate, J. M. Methods of Breeding Alfalfa. Proceedings, American Breeders' Association, Vol. 5 (1909).

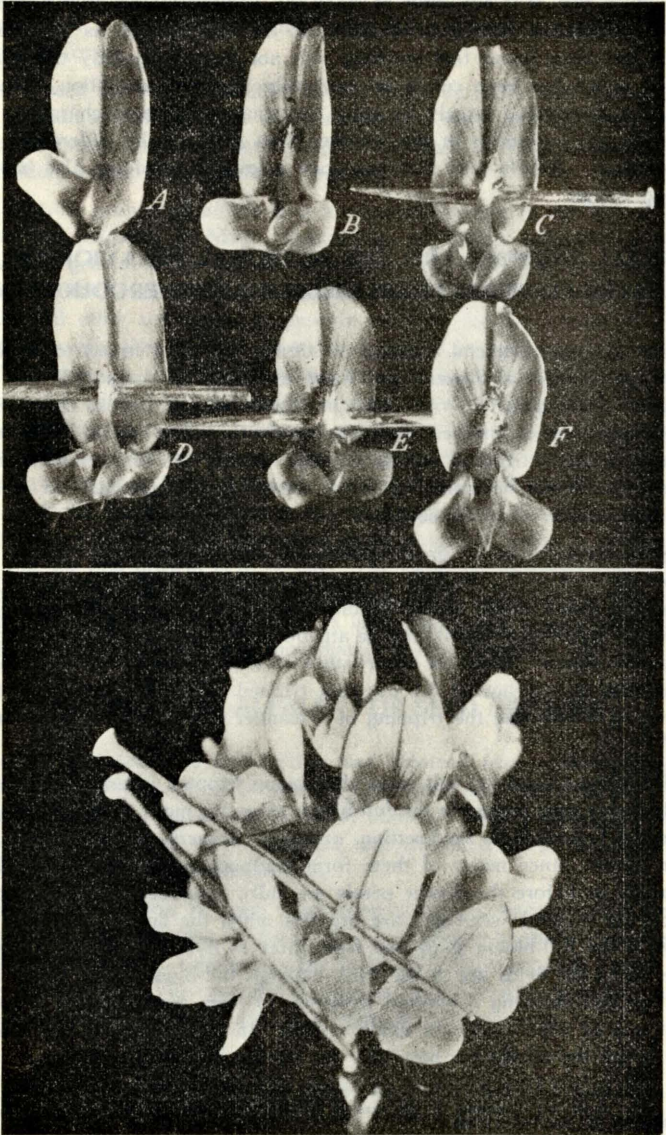


Fig. 6.—Flowers of alfalfa showing:

Above: (enlarged 5 diameters) A—Untripped flower; B—Tripped and probably self-pollinated flower; C—Showing sexual column tripped against a pin; D—Tripped flower from which the pollen has been removed; E and F—showing stigma pollinated with pollen from an alfalfa flower of another variety.

Below: Raceme of alfalfa flowers (enlarged 6 diameters). This illustration shows that when the column of the flower is tripped the pressure is sufficient to hold a small pin. (Reproduced from Bulletin 167, U. S. Dept., Bureau of Plant Industry, with permission from that Bureau.)



Of a total of 27,059 alfalfa flowers observed in 1926 and 1927, 34.2 per cent formed seedpods and the remainder stripped. This appears to be about the average percentage for a favorable year, as the acre-yields for those years at the Experimental Farm ranged from approximately 300 to 800 pounds.

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